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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/502,078	02/10/00	EICHELBERGER	C 1109.005

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EXAMINER
PIZARRO CRESPO, M

ART UNIT	PAPER NUMBER
2814	3

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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/502,078

Applicant(s)

EICHELBERGER ET AL.

Examiner

Marcos D. Pizarro-Crespo

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 February 2000.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 ~~is/are~~ are pending in the application.
- 4a) Of the above claim(s) 18-40 ~~is/are~~ are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 15-17 ~~is/are~~ are rejected.
- 7) ☐ Claim(s) 13,14 ~~is/are~~ are objected to.
- 8) ☒ Claims 1-40 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 February 2000 is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 18) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☒ Other: fig.5f of US 5841193 cited in paper no.2.

Attorney's Docket Number: 1109.005

Filing Date: 2/10/2000

Claimed Foreign Priority Date: none

Applicant(s): Eichelberger et al.

Examiner: Marcos D. Pizarro-Crespo

DETAILED ACTION

This office action is in response to the application filed 2/10/2000.

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-17, drawn to a structure, classified in class 257, subclass 774.
 - II. Claims 18-40, drawn to method, classified in class 438, subclass 622.
2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as product made and process of making. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case unpatentability of the group I invention would not necessarily imply unpatentability of the group II invention, since the device of the group I invention could be made by processes materially different than those of the group II invention, for example, instead of electrically connecting the first and the second electrical structures of claim 1 using an interconnect formed by a metal layer in one via opening in a dielectric layer provided on one of the first and second electrical structures,

as recited in claim 27, the electrical interconnect may be formed prior to providing the dielectric layer.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Mr. Radigan on 6/5/2001 a provisional election was made with traverse to prosecute the invention of group I, claims 1-17. Affirmation of this election must be made by applicant in replying to this office action. Claims 18-40 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

6. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Drawings

7. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character **135** has been used to designate both a chip and an interconnect conductor. Correction is required.

8. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description:

11 415. Correction is required.

9. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description:

160 405. Correction is required.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1, 2, 6-12 and 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eichelberger (US 5,841,193) in view of Frey (US 5,249,101).

12. Eichelberger shows most aspects of the instant invention including a structure (dielectric layer) between a first electrical structure and a second electrical structure, said structure comprising (see attachment: figure 5f):

- A dielectric material disposed on at least one of the first electrical structure and the second electrical structure.

However, Eichelberger does not show the dielectric material comprising a low modulus material having a high ultimate ^(strain)elongation property. Frey discloses a low modulus high elongation (LMHE) dielectric material, i.e., acrylated urethane, which is quickly and

conveniently cured yielding relatively inexpensive, hydrophobic coatings (col.3/ll.13-22, 49-61). This dielectric readily withstands thermal cycling tests without exhibiting any internal cracks or interfacial cracks or delamination (col.3/ll.13-22,49-61). It would have been obvious at the time of the invention to one of ordinary skill in the art to have the dielectric material between the first and the second electrical structures of Eichelberger as the LMHE dielectric material suggested by Frey, because such a modification will provide a structure (dielectric layer) between the first and the second electrical structure which is quickly and conveniently cured yielding a relatively inexpensive and hydrophobic dielectric that readily withstand thermal cycling tests without exhibiting any internal or interfacial cracks or delamination.

13. Regarding claim 2, Frey shows the LMHE dielectric having a Young's modulus of less than 50,000 psi (col.3/ll.20).

14. Regarding claim 6, Eichelberger shows one via opening in the dielectric layer exposing one electrical contact of the first electrical structure (see attached fig.5f).

15. Regarding claim 7, Eichelberger shows a metal layer over the dielectric layer and in the via opening electrically connecting to the electrical contact (see attached fig.5f, col.10/ll.60-61, col.11/ll.19-22).

16. Regarding claim 8, Eichelberger shows the metal layer comprising copper (col.10/ll.65-col.11/ll.4).

17. Regarding claim 9, Eichelberger shows an electrical interconnect connecting the first electrical structure and the second electrical structure (see attached fig.5f). Eichelberger also shows the electrical interconnect being electrically coupled to the

metal layer disposed over the dielectric layer to electrically connect to the electrical contact of the first electrical structure (see attached fig.5f).

18. Regarding claim 10, the LMHE dielectric layer shown by Frey has a Young's modulus (10,000 psi, col.3/ll.20) less than the Young's modulus of the electrical interconnect (16×10^6 psi, see Nippert US 4,149,310 col.2/ll.8-9) shown by Eichelberger.

19. Regarding claim 11, Eichelberger shows the electrical interconnects comprising conductive bumps (raised pads) disposed between the first and the second electrical structure (see attached fig.5f).

20. Regarding claim 12, Eichelberger shows the conductive bumps comprising raised pads (see attached fig.5f).

21. Regarding claim 15, Frey shows the LMHE dielectric material having a Young's modulus of less than 20,000 psi (col.3/ll.20). Additionally, Eichelberger shows the dielectric layer having a thickness of 24 microns (col.10/ll.57).

22. Regarding claim 16, Frey shows the LMHE dielectric material comprising an acrylated urethane material (col.3/ll.15).

23. Regarding claim 17, Eichelberger shows the first and second electrical structure comprising a multichip module (see attached fig.5f, col.8/ll.23-26).

24. Claims 1 and 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eichelberger in view of Brooks (US 5,903,046).

25. Eichelberger shows most aspects of the instant invention including a structure between a first electrical structure and a second electrical structure, said structure comprising (see attached fig.5f):

- A dielectric material disposed on at least one of the first electrical structure and the second electrical structure (see attached fig.5f).

However, Eichelberger does not show the dielectric material comprising a low modulus material having a high ultimate elongation property. Brooks shows a low modulus high elongation (LMHE) dielectric material which is extremely durable and tough, and processable and stable under the conditions of standard semiconductor manufacturing process (col.3/ll.41-51). It would have been obvious at the time of the invention to one of ordinary skill in the art to have the dielectric material between the first and second electrical structures of Eichelberger as the LMHE dielectric material suggested by Brooks, because such a modification will provide a structure (dielectric layer) between the first and the second electrical structure which is extremely durable and tough, and processable and stable under the conditions of standard semiconductor manufacturing process.

26. Regarding claim 3, Brooks shows the LMHE dielectric may have an ultimate elongation property of 25% (col.3/ll.44).

27. Regarding claim 4, Brooks shows the LMHE dielectric comprising a photopatternable dielectric layer (col.3/ll.48-51).

28. Regarding claim 5, Eichelberger shows the photopatternable dielectric layer is 24 microns thick (col.10/ll56-58). Although, the claimed value, i.e., at least 25 microns, and the prior art values of the dielectric layer do not overlap, it has been held that a prima facie case of obviousness exists where the claimed ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same

properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985). It appears that a thickness of 25 microns instead of 24 microns for the dielectric layer of Eichelberger will not impart unexpected properties to the dielectric layer and therefore would have been obvious.

Allowable Subject Matter

29. Claims 13 and 14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

30. The following is a statement of reasons for the indication of allowable subject matter:

None of the references of record disclose or can be fairly combined to yield a structure for absorbing stress between a first electrical structure and a second electrical structure, said structure comprising a metal layer over a LMHE dielectric layer, said LMHE dielectric layer disposed on at least one of the first and second electrical structures, said metal layer comprising a conductor above the dielectric layer, and said conductor having a length L greater than a maximum displacement between the first and second electrical structures to facilitate stretching of the conductor. Eichelberger, a closest reference, shows a structure comprising a metal layer including a conductor over a LMHE dielectric layer disposed between a first and a second electrical structure, but fails to show the conductor having a length L greater than a maximum displacement between the first and second electrical structures to facilitate stretching of said conductor.

Conclusion

Papers related to this application may be submitted directly to Art Unit 2814 by facsimile transmission. Papers should be faxed to Art Unit 2814 via the Art Unit 2814 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2814 Fax Center number is (703) 308-7722 or -7724. The Art Unit 2814 Fax Center is to be used only for papers related to Art Unit 2814 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Marcos D. Pizarro-Crespo** at **(703) 308-6558** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via Marcos.Pizarro@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

The following list is the Examiner's field of search for the present office action:

Field of Search	Date
U.S. Class / Subclass(es): 257/678-733	6/8/2001
Other Documentation:	
Electronic Database(s): EAST (USPAT, EPO, JPO)	6/8/2001

MDP/mdp
June 14, 2001

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